OPERATION AND MAINTENANCE MANUAL

Test Set - Distributor Cam Dwell and Engine RPM MIL-T-10357C Model TD-100

MP MASTER
MA32648

GENERAL METERS, INC.
Grand Junction, Colorado

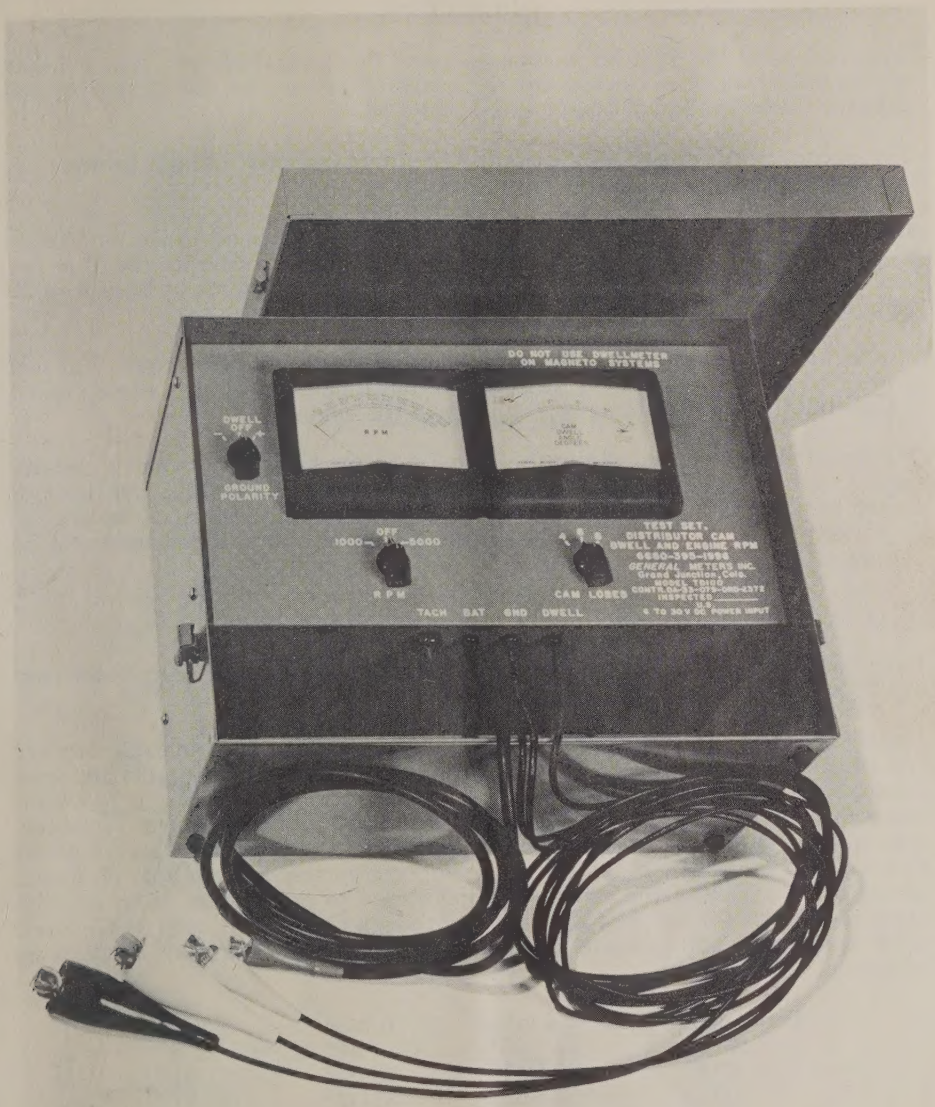

Fig. 1 TEST SET - DISTRIBUTOR
Cam Dwell and Engine RPM
General Meters Model TD-100
MIL-T-10357C

OPERATION

The model TD-100 Test Set as manufactured by General Meters, Inc., consists of two independent measuring circuits, enclosed in one case for measuring distributor Cam Dwell and Engine speed or RPM.

The circuits may be used independently or simultaneously without interaction, or interference with the engine performance.

Engine speed is measured by connecting the tachometer lead to any one spark plug of an engine, and grounding the Test Set. Power to operate the Test Set is obtained from the vehicle battery or an independent source of from 6 to 30 volts D.C.

The tachometer circuit will also operate on a magneto ignition system, but will require an independent power source. The tachometer gives true engine speed independently of the number of cylinders in the engine.

The dwell circuit operates from the primary connection of the vehicle distributor. As the dwell reading varies with the number of cylinders, the cam selector switch must be properly set for the correct number of cylinders in the engine. The dwell circuit is not useable on magneto ignition systems and must not be connected to a magneto.

CAM DWELL ANGLE

Cam dwell or cam angle is the actual angle of rotation of the distributor cam during which contact points remain closed.

During the rotation of the distributor cam, the cam lifts the moveable breaker arm, and opens the contacts. The percentage of rotation the contacts are open is usually adjusted by setting the fixed breaker point. In the past it has been customary to measure the point gap by means of a "feeler" gage. However, this method is not satisfactory, as irregularities in the contact faces tend to give false readings. Each point opening spacing corresponds to a dwell angle, or angle of rotation of the cam from point closed to point open. However, the angle is different for 4, 6, or 8 lobe cams, although the percent open "vs" closed is the same. The approximate relation of point opening "vs" cam angle is as follows:

Point opening	4 lobe	6 lobe	8 lobe
50%	45°	30°	22.5°
.016	40-47°	28-34°	21-31°
.022	57-65°	31-37°	27-37°

The proper cam dwell angle is specified by the manufacturer, and should be used. If such data is unavailable, the above values may be used as an approximation, but every effort should be made to obtain the correct setting.

TESTING CAM DWELL ANGLE

To test the cam dwell angle with the Model TD-100 Test Set, connect the ground test lead to a good ground on the vehicle. Connect the battery lead to the ungrounded side of the battery and the dwell lead to the primary terminal of the engine distributor.

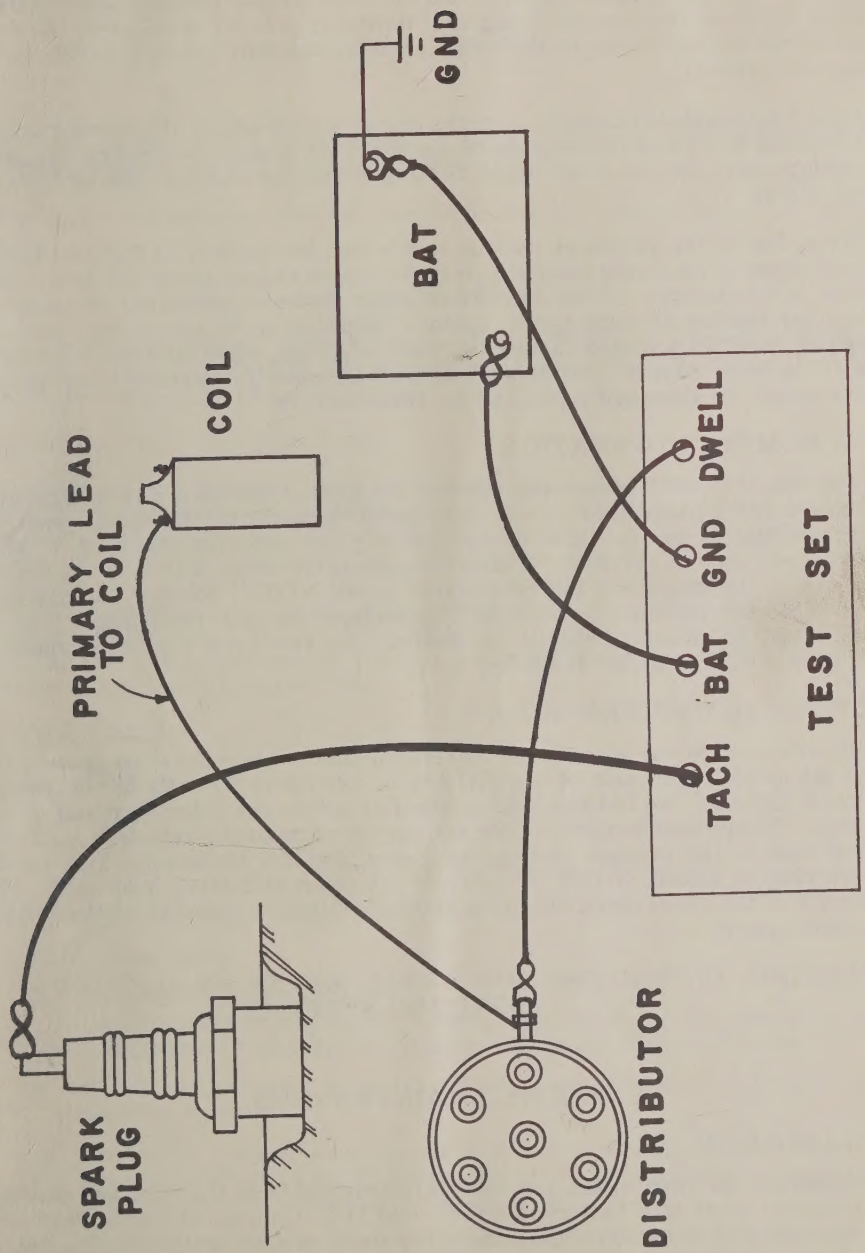

Fig. 2 Connection of Test Set to Engine

Turn the cam selector switch to the proper cam lobe position, and start the engine. Turn the polarity selector switch to the proper polarity and the dwell meter will read the cam dwell angle. If improper polarity is selected, the dwell meter will read off-scale to the right. In this case shift polarity switch to the opposite polarity.

If the dwell angle is incorrect, stop the engine and re-adjust the breaker points. Increasing the point opening decreases the dwell angle. Decreasing the point opening, increases the dwell angle. Setting should be made at 500 to 1500 engine RPM.

The action of the points at various speeds can be checked as follows: If cam dwell angle is relatively constant over the entire engine speed the point operation is satisfactory. If the cam dwell angle varies considerably or shows an irregular reading at some speed, contact vibration on bounce is indicated. Irregular readings are also caused by worn bushings, worn or bent distributor shaft, or loose advance mechanism. If such irregularity is present the distributor should be thoroughly checked for these defects.

TACHOMETER OPERATION

To use the TD-100 Tachometer, connect the ground lead to the vehicle ground. Connect the battery lead to an ungrounded terminal of the vehicle battery. Connect the tachometer lead to any spark plug, removing shielding or using special adapters as necessary. Turn the tachometer range switch to the desired range and the meter will indicate engine speed. NOTE: Battery polarity does not affect the tachometer reading. The tachometer and dwell meter may be used together or independently as desired. For two cycle engines connect as above and divide the RPM reading by 2.

EXTERNAL BATTERY SUPPLY

If it is desired to use an external battery outside of the vehicle to operate the test set, connect one side of any battery of from 6 to 30 volts to the vehicle ground. Connect the battery lead of the test set to the other terminal of the battery. The ground terminal of the test set connects to the vehicle ground, the dwell lead to the primary of the distributor, and the tachometer lead to the spark plug as before. NOTE: Polarity of the external battery is optional. The polarity of the dwell meter circuit is determined by the polarity of the vehicle ignition system.

WARNING: DO NOT USE THE DWELL METER ON MAGNETO IGNITION SYSTEMS.

TEST SET MAINTENANCE

CALIBRATION

To calibrate the dwell meter, remove the instrument from the case, and connect the battery leads to a battery, 6 to 30 volts D.C. Connect the dwell lead clip to the ground battery terminal, rotate the dwell selector switch to the 8 lobe position. Adjust the potentiometer R12 (See diagram 3) until the dwell meter reads exactly 45°. At this point connect the dwell meter to an operating engine and measure the actual dwell angle. If contacts are properly set, this will be about 22 to 25 degrees. Assume the actual measurement to be 22½ degrees.

To set the 6 lobe position of the test set, multiply the reading as obtained above by the factor $\frac{8}{6}$ or $\frac{4}{3}$.

i.e. divide 22.5 by 3, and multiply by 4

$$22.5 \times \frac{4}{3} = 30.$$

Turn test set lobe switch to the 6 lobe position, and adjust potentiometer R11 to obtain a meter reading of 30 on the dwell meter.

To set the 4 lobe position, multiply the 8 lobe reading obtained above the factor $\frac{8}{4}$ or 2:

$$22.5 \times 2 = 45$$

Turn test set lobe switch to the 4 lobe position, and adjust potentiometer R10 to obtain a meter reading of 45 on the dwell meter. This concludes the calibration proceedure for the dwell meter.

TACHOMETER CALIBRATION

To calibrate the tachometer portion, connect the tachometer to an operating engine or to a coil ignition mock-up on a distributor tester including an accurate tachometer. Turn the tachometer selector switch to the 1000 range and adjust the engine or distributor test set speed to exactly 1000 RPM. Adjust the potentiometer R8 to make the tachometer meter read 1000. Turn the Tachometer-Dwell Meter tachometer range switch to the 5000 range and adjust the engine or distributor tester to 2500 RPM, then adjust the potentiometer R9 to make the Tachometer meter indicate 2500 RPM. This concludes the calibration of the Tachometer section.

LUBRICATION

No lubrication is required.

TROUBLE CHART

TACHOMETER AND DWELL METER

A. Both Inoperative.

1. Vibrator does not operate.
   Check ballast for continuity. Check for battery voltage between frame and terminal 1 of vibrator. If none, check the leads for breaks.
2. If the ballast lamp is brightly illuminated, vibrator is shorted, and must be replaced.
3. Check the voltage from the battery lead to the top fixed contact of the over voltage relay. If none, relay contacts are open, or corroded. Inspect, clean or if necessary replace relay.
4. Check the voltage on the terminals 2 and 3 of the vibrator. If there is no voltage, transformer primary is open circuited.
5. Vibrator operating.
   Check the transformer output terminals (red leads) with an A.C. volt-

meter. It should read 160 to 180 volts. If not, the transformer is defective. If less than 160 there is a short in the power supply beyond the rectifier or the buffer capacitor is shorted.

6. If the A.C. voltage is correct check the D.C. voltage across the filter capacitor C2. This should read between 120 to 150 volts. If zero, the capacitor is shorted; if below 100 volts C2 is leaking, or the rectifier D1 is defective.

7. If the 2.2 K resistor R-1 is hot or burned, the short is in the other components or wires beyond the power supply.

8. NOTE: If the short is beyond the Tachometer meter, this meter will read beyond full scale. If the meter does not do this, the short is in the wiring to the tachometer range switch.

9. Measure the voltage across the OB2 tube terminals 1 and 2. It should be 105 ± 2 volts. If it is not, the tube is defective.

B. TACHOMETER IS OPERATIVE, BUT THE DWELL METER IS IN-OPERATIVE.

1. If power supply voltage is correct as checked above in Section A;

2. The meter is defective. Check with a standard meter, it should read 100 microamperes or less.

3. Check the diode D2. The forward resistance should be less than 3000 ohms at 1.5 volts. Backward leakage should be less than 2 microamperes at 22½ volts.

4. Check the polarity switch contacts for continuity.

5. Check the junction of the 9.1 K resistor R7, 180 K resistor R3, and the diode D2 with a vacuum tube voltmeter. Correct reading should be 4.1 to 5.5 volts. When the dwell leads are disconnected and voltage is high, 9.1 K resistor is open, if low or zero the 180 K resistor is open.

6. Check the .01 bypass condenser for short. If shorted, replace.

7. Check the remainder of the dwell circuit for open or shorts in accordance with the wiring diagram.

C. DWELL METER IS OPERATIVE, BUT TACHOMETER IS INOPERATIVE.

1. If the power supply is operative in accordance with Section A; check the meter against a standard. It should read 180 ± 10 Microamperes full scale.

2. Observe the operation of the test set connected to the engine. The 5823 tube should show a diffused blue flash on the anode at each spark. If there is observed a sharp flash, particularly reddish or yellowish, replace the tube. If there is no flash, check the 3.9 megohm resistor R5, and the 1 megohm resistor R6, and the associated leads. If one range is operative and the other is inoperative, check the appropriate capacitors C3 and C4 and the potentiometers R8 and R9 for that range.

3. Check the circuit for opens or shorts in accordance with the wiring diagram.

D. THE SET OPERATES BUT THE CALIBRATION CHANGES.

1. Both meters are off calibration. Check the voltage regulator OB2 tube in accordance with Section A9.
2. The tachometer is operative but dwell meter is in error for all ranges. Check the 9.1 K resistors R7, and 180 K resistors R3, diode D2, and meter.
3. Some ranges are correct. Check the appropriate calibration potentiometer setting; on range 6 check 8.2 K resistor R13, on range 8 check 15 K resistor R 14.
4. Dwell meter is operative but the tachometer is in error for both ranges. Check the 5823 tube, the meter, the 47 K resistor R4, and the 3.9 and 1 megohm resistors, R5 and R6.
5. Some of the ranges are operative. Check the appropriate calibration potentiometer and capacitors. C_4 for high range, C_3 for low range.

PARTS LIST

The parts list contains a tabulation of all parts used in the test set. The parts are indentified by a symbol letter or number which appears on the assembly drawings. To indentify a part, find the symbol callout on the assembly drawing and refer to the parts list. If the part is made by General Meters, or has special characteristics it will be indentified by a GMI part number. Standard parts are identified by the code "Comml", which means that the part is generally available from several sources, or by a code letter group, which may be identified by the Vendor Code List.

REPLACEMENT PARTS

Replacement parts requests should identify the desired parts by symbol number, name and name of the test set.

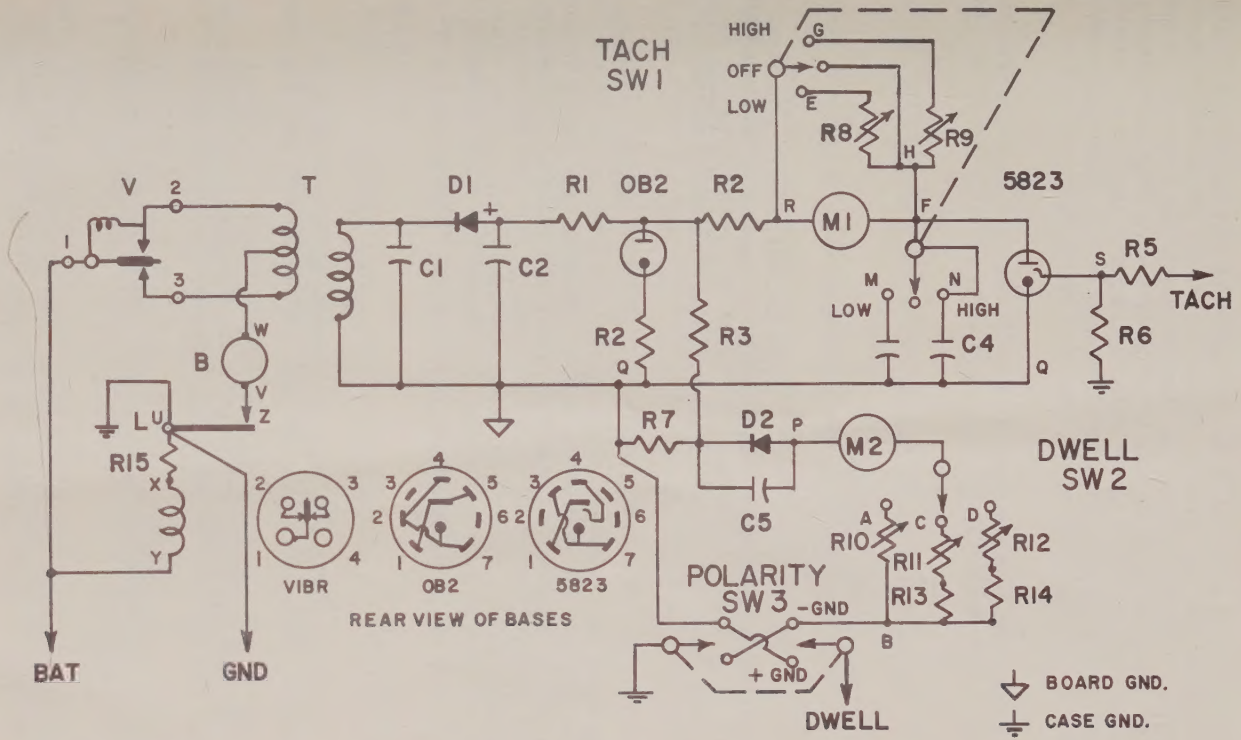

Fig. 3 Wiring Diagram

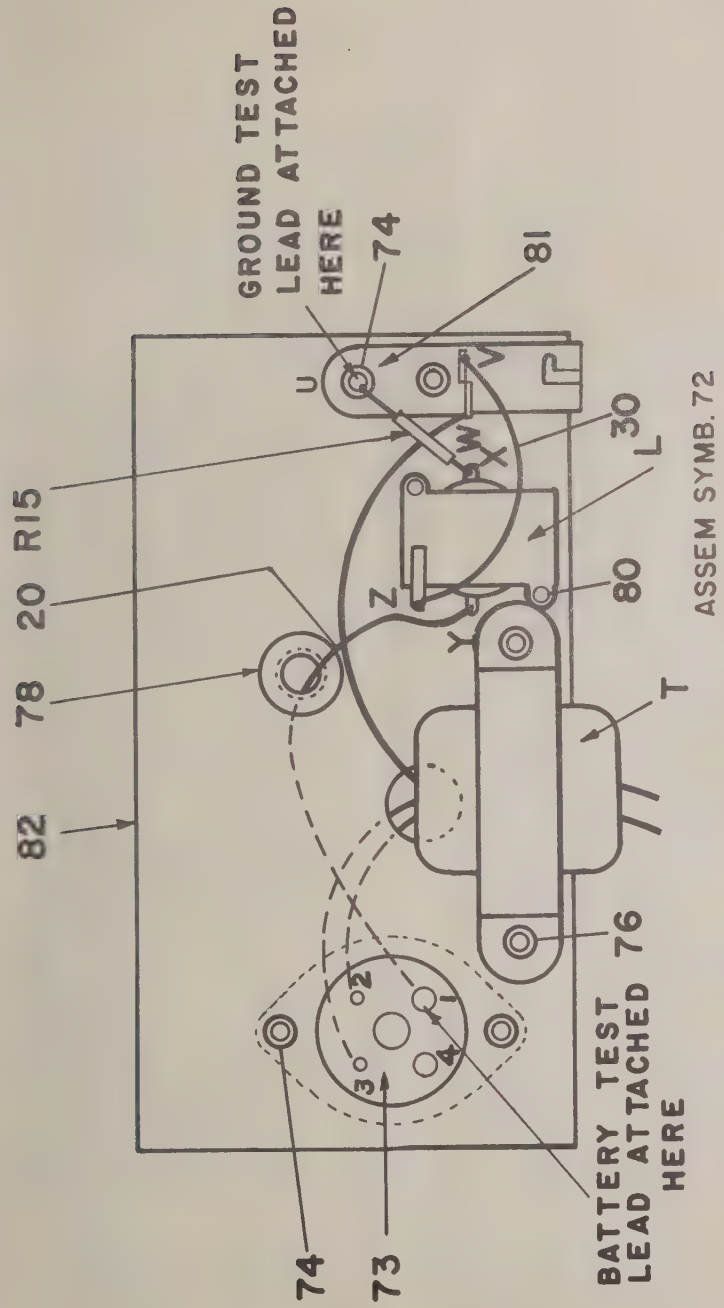

Fig. 4 Hanger Assembly

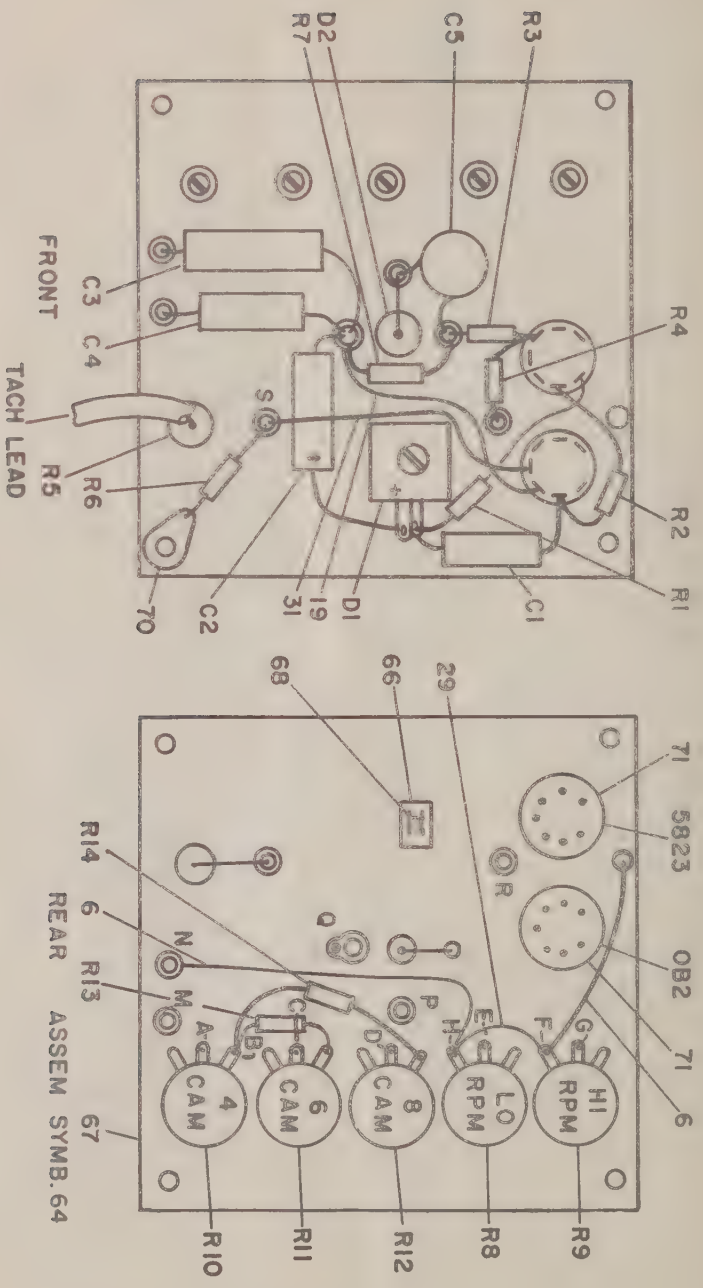

Fig. 5 Sub-Panel Assembly and Wiring

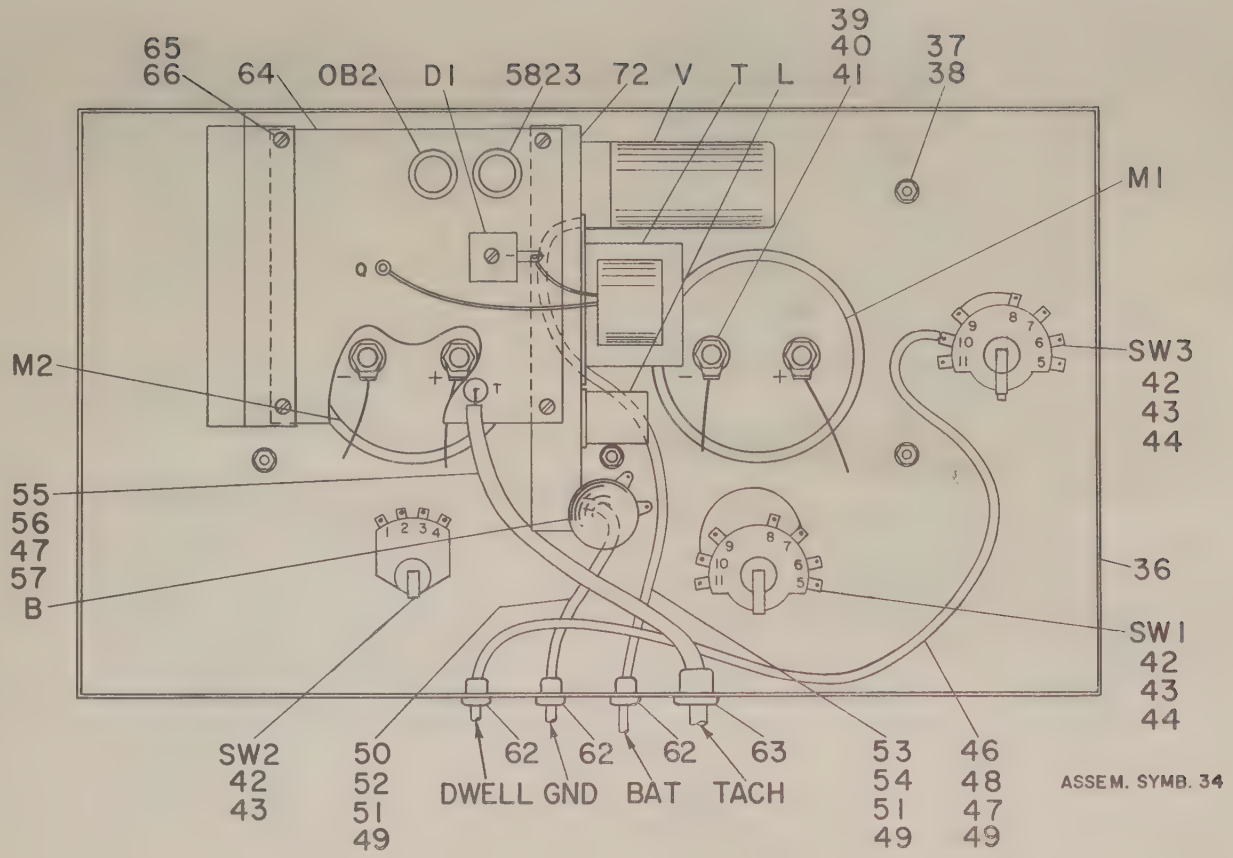

Fig. 6 Meter Panel Assembly

SYMB.	REQ.	NAME	GMI PART NO.	SOURCE CODE	SOURCE NUMBER
		Assembly-Test Set	TD 100		
32	1	Lid, Case	TD 102		
33	1	Case	TD 103		
34	1	Panel Assembly	TD 116		
35	9	Screws-Panel No. 6 x 3/8 Pan Head Sheet Metal Type A or Z		COMML	
36	1	Panel Frame	TD 115		
M2	1	Meter-Dwell	MM206-PDS15		
M1	1	Meter-Tach	MM206-PDS14		
37	8	Nut - 6-32 x 5/16 Brass Hex,		COMML	
38	8	Lockwasher No. 6 int. tooth Brz.		COMML	
39	4	Nut - 1/4-28 x 3/8 Brass Hex		COMML	
40	4	Lockwasher 1/4 int. tooth Brz.		COMML	
41	4	Lug-Solder		ZIE	29A-250
SW1	1	Switch - Tach Range	TD 119		
SW2	1	Switch - Dwell Range	TD 120		
SW3	1	Switch Dwell Polarity	TD 119		
42	3	Nut - Control 3/8-32 x 9/16		COMML	
43	3	Lockwasher-Control 3/8 D.		COMML	
44	3	Knob-Control w/setscrew		GLC	990SS
V	1	Vibrator		VK	NP42P
B	1	Ballast	TD 122		
46	1	Lead, Dwell	TD 128-2		
47	1	Clip-Battery 10A	MIL-C-15612 tp. PC	MUE	48B
48	1	Insulator-Clip (Yellow)		MUE	49
49	108″	Wire No. 14 AWG	MIL-C-13486 tp. 1		
50	1	Lead, Ground	TD 127-1		
51	1	Clip Battery 25A	MIL-C-15612 tp. PC	MUE	24A
52	1	Insulator Clip (Black)		MUE	26
49	108″	Wire No. 14 AWG	MIL-C-13486 tp. 1		

SYMB.	REQ.	NAME	GMI PART NO.	SOURCE CODE	SOURCE NUMBER
53	1	Lead, Battery	TD 127-2		
51	1	Clip, Battery 25A	MIL-C-15612 tp. PC	MUE	24A
54	1	Insulator - Clip (White)		MUE	26
49	108″	Wire No. 14 AWG	MIL-C-13486 tp. 1		
55	1	Lead Tachometer	TD 128-1		
47	1	Clip-Battery 10A	MIL-C-15612 tp. PC	MUE	48B
56	1	Insulator - Clip (Red)		MUE	49
57	108″	Wire 7 mm	MIL-C-3162 tp. 1 gr. A cl. 1		
62	3	Bushing - Strain relief		H	SR-2M-1
63	1	Bushing - Strain relief		H	SR-6P-1
64	1	Electronic Subpanel	TD 118		
65	4	Screw 6-32 x 1/4 RH Mach Steel		COMML	
66	4	Nut - Speed		TM	C7000-632-4
67	1	Subpanel with Eyelets	TD 112		
66	1	Nut Speed		TM	C7000-632-4
69	1	Screw No. 6-32 x 7/8 RH Steel		COMML	
70	1	Lug		ZIE	7-144TC
71	2	Socket 7 pin min (with ring)		AML	78-7P
R1	1	Resistor 2200 Ohm ½W ± 10%		SP	SR ½W
R2	1	Resistor 68 Ohm ½W ± 20%		SP	SR ½W
R3	1	Resistor 180K Ohm ½W ± 5%		SP	SR ½W
R4	1	Resistor 47000 Ohm ½W ± 10%		SP	SR ½W
R5	1	Resistor 4.9 Megohm 2W ± 10%		SP	SR 2W
R6	1	Resistor 1 Megohm ½W ± 10%		SP	SR ½W
R7	1	Resistor 9100 Ohm ½W ± 5%		SP	SR ½W
R8	1	Potent. 12,000 Ohm	TD 134		
R9	1	Potent. 12,000 Ohm	TD 134		
R10	1	Potent. 12,000 Ohm	TD 134		
R11	1	Potent. 12,000 Ohm	TD 134		

PARTS LIST (cont)

SYMB.	REQ.	NAME	GMI PART NO.	SOURCE CODE	SOURCE NUMBER
R12	1	Potent. 12,000 Ohm	TD 134		
R13	1	Resistor 8200 Ohm ½W ± 10%		SP	SR ½W
R14	1	Resistor 15000 Ohm ½W ± 10%		SP	SR ½W
C1	1	Capacitor .1 mfd 200 V.		GD	Type 663UW
C2	1	Capacitor 8 mfd 150 V.		PY	TD8-150-Single
C3	1	Capacitor .39 mfd 100 V.		GD	Type 663UW
C4	1	Capacitor .1 mfd 200 V.		GD	Type 663UW
C5	1	Capacitor .01 mfd 600 V.		GD	Type GMV
5823	1	Tube, Gas Trigger		COMML	
OB2	1	Tube, Volt Regulator		COMML	
D1	1	Rectifier		IRC	RS065Q
D2	1	Diode, Silicon		IRC	SD91
6	2	Wires	TD 126-6		
19	1	Wires	TD 126-19		
29	1	Wires	TD 126-29		
31	1	Wires	TD 126-31		
72	1	Hanger Assembly	TD 109		
93	1	Socket 4 Pin		EBY	34-1-AA
74	2	Eyelet 1/8D x 3/16L		COMML	
T	1	Transformer	TD 129		
76	2	Eyelet 3/16D x 1/8L		COMML	
78	1	Grommet 3/8 id		AIR	230-½
L	1	Relay-Special	TD 113		
80	2	4-40 x 1/4 RHMS Steel with Lockwashers (Sems)		COMML	
81	1	Socket, Ballast	TD 133		
74	2	Eyelet 1/8D x 3/16L		COMML	
82	1	Hanger	TD 110		
R15	1	Resistor 4700 Ohm ½W ±10%		SP	SR ½W
20	1	Wire	TD 126-20		
30	1	Wire	TD 126-30		

PARTS LIST (cont)

VENDORS' CODE

CODE	VENDOR'S NAME AND ADDRESS
COMML	Standard Item—Available many sources, or may have MIL or MS equivalent.
AML	AMPHENOL ELECTRONICS CORP. Chicago, Ill.
AIR	ATLANTIC INDIA RUBBER WORKS, INC. Chicago, Ill.
EBY	EBY SALES CO. New York, N.Y.
GLC	GEE LAR MFG. CO. Rockford, Ill.
GD	GOOD-ALL ELECTRIC MFG. CO. Ogallala, Neb.
IRC	INTERNATIONAL RECTIFIER CORP. El Segundo, Calif.
MUE	MUELLER ELECTRIC CO. Cleveland, Ohio
PY	PYRAMID ELECTRIC CO. Darlington, S.C.
SP	SPEER RESISTOR DIV. Bradford, Penna.
VK	VOKAR Ann Arbor, Mich.
ZIE	ZIERICK MFG. CORP. New Rochelle, N.Y.

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